The Effect of a Negotiator's Plan B

Optimal Negotiation Decision Functions with a Reservation Value

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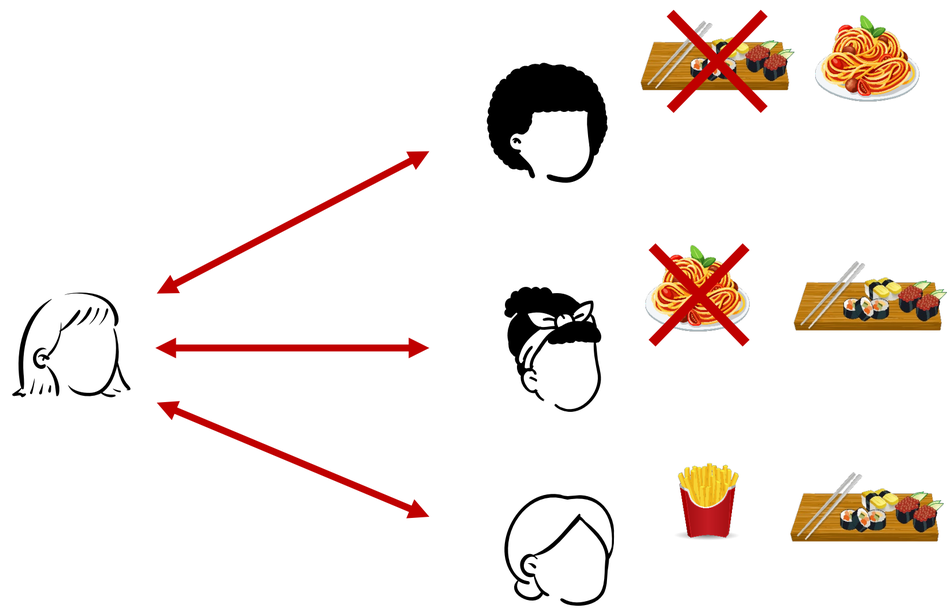
Introduction to multi-agent negotiation

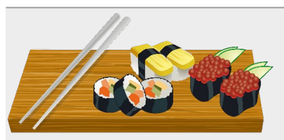
Goal: Reach a (good) agreement.

Challenge: Coordinate negotiations with multiple agents at the same time.

Idea: Treat other negotiations as **backup plan.** The corresponding utility value is called a **reservation value.**



Example: What shall we eat for dinner?

Proposal bid	Utility (u_i)	Acceptance probability (a_i)	Expected utility $(EU_{\mathbf{rv}})$
	0.8	0.2	0.16
	0.3	0.9	0.27
	0.2	**Reservation value**	

With one bid, what would you do?

Without reservation value

Expected utility: 0.27

With reservation value

Expected utility: 0.32

$0.16 + (1 - 0.2) * 0.2$

Expected utility: 0.29

$0.27 + (1 - 0.9) * 0.2$

With k bids, what would you do?

Goal: Find the sequence π that maximizes the expected utility $EU_{\mathbf{rv}}$

$$EU_{\mathbf{rv}}(\pi) = \sum_{i=1}^{k} u_i \cdot a_i \prod_{j=1}^{i-1}(1 - a_j) + \mathbf{rv} \cdot \prod_{j=1}^{k}(1 - a_j)$$

Challenge: Evaluating all sequences takes too long.

Optimal strategy:

- Take the best bid sequence of length *k.*
- Greedily select the best additional bid to find the sequence of length *k+1.*

Future research

What if there is more than one backup plan?

What if the backup plan is probabilistic?

What if each bid has a specific cost?

What if…?

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